Vicki Bruce

Professor Vicki Bruce OBE FBA is Head of the School of Psychology at the University of Newcastle. A video of extracts from this interview can be found via www.britishacademy.ac.uk/prosperingwisely/bruce

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What was the initial spark that made you get into studying and working in psychology?

Vicki Bruce
Before I went to university I was a computer programmer. That was in 1971, before most people had computers. I worked writing laborious programs to do very simple statistical things. But it meant that, when I picked up psychology as one of my subjects, without knowing what it was, I had a very good understanding of what it might be to think of a brain as something that needed to process information. I was immediately absolutely hooked on psychology through the idea that you could understand the brain, and understand the mind, as a kind of computer. I absolutely loved the idea that people were talking about this very clever machine between our ears. And I had an enormous advantage at that time, because I had worked as a computer programmer, so I understood what an information-processing model would look like – the sorts of flow charts that we used to draw before we wrote software. The information-processing model was just coming through psychology in the late '60s and early '70s, in terms that I could actually understand and make a contribution to.

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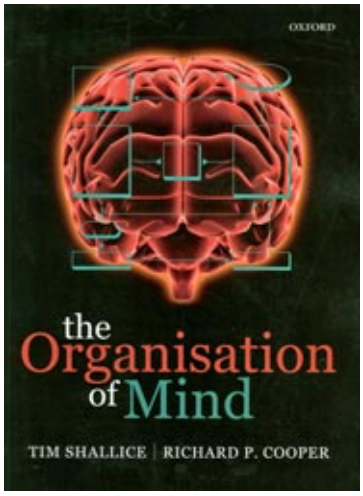
At what point did you realise it was going to become a career?

Vicki Bruce
Possibly like many people, I was driven to do a PhD through curiosity, from things I found out as a student. At that point it was simply like a love affair. I didn't want to stop. And so there was no doubt in my mind that I wanted to continue to do the sorts of things that I had done through my PhD. So it wasn't a gradual realisation; I didn't drift into the life academic and stay there because nothing else tempted me. It was absolutely – absolutely – what I wanted to do. The research questions, and the research excitement. And the excitement of working in a discipline that was becoming mature at that point, but which was still a relatively young discipline, where relatively junior people could make contributions. That was simply what I wanted to do.

At the same time – and this is something I feel equally passionate about – I loved teaching. I did quite a lot of teaching while I was a PhD student, and knew that I wanted to continue to teach in universities as well as to do research. That was what I wanted to do, and that is what I have done ever since.



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What is the value of psychology?

Vicki Bruce
If you want to understand what it is that parts of the brain are doing when, using current brain imaging technologies, you see parts of the brain lighting up, you have to have an understanding of the functional side of what the mind is. You need to understand the things the brain is trying to achieve, not just which bits are active, otherwise you can't actually understand what that brain map is about at all. So, at a theoretical level, psychologists are the people who try to understand what the different things are that allow us to do all the different things that are very important in different areas of human life.[1]

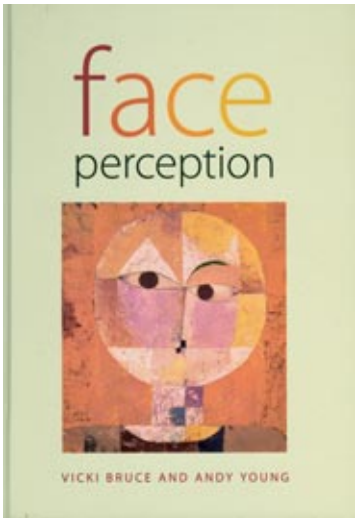
Psychology is the perfect discipline. It's a science – it uses a scientific method, it's rigorous. It is applied, so psychologists can make a difference to people's lives. It has got interdisciplinary interfaces with biological sciences, medical sciences, engineering sciences.

This excellent account by Tim Shallice FBA & Rick Cooper won the authors a British Academy Medal in 2013.

[1] See Tim Shallice & Rick Cooper, *The Organisation of Mind* (2011). For this book, the authors were awarded in 2013 a British Academy Medal for outstanding achievement in the humanities and social sciences.

At practical levels, these interfaces with other disciplines lead to a range of applications. We have methodologies that help us work with engineers so that we can better design things that people will use. To use an example from my own work, I was involved for a number of years in working with the Royal Mint to evaluate proposed changes to UK coins, and to try to ensure that coins, when they were introduced, were not confused with other coins – particularly by people who might be frail or vulnerable or not able to see. So, the pound in your pocket is as thick as it is because when we did our research on 'Coin X' – we weren't allowed to say it was going to be a pound coin, because it was all very top secret – we discovered that the additional thickness was essential to prevent confusions between the pound coin and the then five pence coin by people who couldn't see.[2] It would be very easy to say to somebody 'Here's your pound change', and give them a five pence. That extra thickness turned something that was easily confusable into something that actually was very difficult to confuse. When people complain about the fatness and the weight of our pound coins, I feel very proud. That was actually a really good design, and it needed careful experiments comparing how easily you could sort things out by sight, by touch and in dim light, using different variants of the coins. That is using a methodology to work at the interface between psychology and the people who knew how to get certain metals to work together.

Other kinds of interfaces are between psychologists and medics. There are a number of both congenital and acquired deficiencies in areas such as face processing. You might be somebody who is born with difficulties recognising faces. Or you might have a brain injury and – although it's rare – you might end up unable to recognise faces. Psychologists might work with people in medical areas to think about rehabilitation techniques for people with problems acquired through injury. They might work with engineers or computer scientists to think about trying to develop what we will call cognitive prosthetics: things that you might be able to do to substitute for the kinds of functions that you have lost.



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Talk more about your work on face recognition.

Vicki Bruce
Just at about the time that I was thinking of doing a PhD in psychology, there were two very interesting observations, one entirely practical and applied, and one theoretical. On the theoretical side, psychologists, who had been interested in learning rather than memory and interested in words rather than images, were just rediscovering visual memory and discovering that people could be terribly good at remembering faces. That was rather interesting. At the same time, there were lots and lots of cases of appalling mis-carriages of justice. Witnesses had testified that people were the people who had committed crimes, which led to their convictions. But the people were innocent – they hadn't done it. We had this extraordinary paradox – that people were good at remembering faces and very bad at remembering faces. And that was a stimulus to the work that I have done on face perception and face recognition, which has actually carried me through my scientific career. And the field of face recognition and witness memory has grown enormously, both in the UK and internationally. We've changed the way that people interview witnesses, to get more correct information and less incorrect information. We've helped change the tools that are used when working with witnesses to help people remember faces. We have made discoveries which are actually taken into the courtroom, and which hopefully inform judgments that could otherwise be based on rather fragile, inappropriate use of resemblance between people. Resemblances between people don't necessarily mean that *that* person *is* the same person as is shown in a CCTV image, for example.

We've helped change the tools that are used when working with witnesses to help people remember faces.

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How does that sort of research evolve?

Vicki Bruce
I liken my own research area to moving up a spring, so that progress is onwards, but sometimes one appears to go backwards a little bit. And that is often because what is happening as you turn the corner of the spring is that you are beginning to ask questions in a slightly different way, or you are beginning to get new technology that allows you to make an advance, or you are realising that the way that you framed that question doesn't make sense once you think about this broader context. Even though some might say 'Well, it's confusing, because some people are saying this and some people are saying this other thing', actually there really is an accumulation of understanding, which moves in a particular direction. But it is always going to be a little bit like the spring, where you move on, but you have to be able to take some steps that might seem to be retracing your steps.

I'll give you an example in my own area of face recognition. How do we recognise human faces, given that everybody's face is the same? Everybody's face has to fulfil the same basic biological functions. Everybody's face has got two eyes, placed the same distance apart so we can see

[2] V. Bruce, C.I. Howarth, D. Clark-Carter, A.G. Dodds & A.D. Heyes, 'All change for the pound: Human performance tests with different versions of the proposed UK one pound coin', *Ergonomics*, 26 (1983), 215-27.

in stereo. We have a nose above a mouth. We have our ears at the same location to do sound localisation. Our lips and jaws and tongue have to be a certain configuration, so that we can speak. We have certain diets that are very different from other sorts of mammals' diets, so we have certain sorts of teeth and not others. You have got a basic template. Despite the fact our faces are all the same, they carry this bewildering variety of important social signals. Your face tells somebody else a little bit about what you are feeling, a little bit about what you are thinking. Are you thinking about the person you are talking to? Or are you thinking about the fact that you have got to pick something up at the dry cleaners later? It tells you about some of the things you are saying – we all lip read. And it also conveys identity. Faces are our best way of recognising people. So, how do you recognise the very subtle variations on that basic template? How does your brain do that?[3]

A comparison between an average male face surface and an average female face surface. The red and cream colours highlight the more protuberant male nose, jaw and voice box, and the female cheeks and fleshy top of chin. (Image: Professor Alf Linney, University College London.)

At the time that I was first trying to understand how it is that we recognise faces – what kind of description of a face does the brain hold that allows it to know that this is Fred's face or Joe's face? – I was working within a theoretical framework that was emphasising our delivery from visual objects of a three-dimensional description. We thought that the secret to how we recognise faces is that the brain builds a three-dimensional description of each person's face. And we spent quite a lot of time and research effort doing some really rather difficult things at that time – because this was during the 1980s – trying to do experiments on three-dimensional representations of faces.[4] They were obtained by working with medical physicists, who were using laser scanning to build range maps of faces. After some years, the experiments revealed to me – I am absolutely sure that this is right, but not everybody would agree – that actually this is not how the brain describes faces. Our representations for face-recognition, I am now persuaded, are not based on three-dimensional descriptions at all. They are based on a rather simple, two-dimensional set of low-level lights and darks – a very simple image description. Now, it's not that the brain doesn't describe faces in three dimensions. Of course, it does. If I wanted to reach out and punch you on the nose now, I would need to know how far your nose juts out in comparison with your cheek. So we do have a description. But it's not, we now believe, the basis of recognising faces. Recognising faces is based on something rather simpler than that. That is an example of how you can take these twists and turns and do quite a lot of research driven by one particular question, and then find something different.

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You were talking about how your work has affected the use of CCTV evidence in court.

Vicki Bruce

We were working on how to build a computer system that could recognise faces in the same sorts of ways that human brains recognise faces. This is because building a computer system gives you a model. We had one sort of theory of what kind of process would be involved, and we wanted to test that computer model against human face matching.[5] To do that, we needed gold standards of how well humans matched faces and what happened to that matching performance as you varied the viewpoint and the expression between the face that was the target and the faces you were trying to match against. I sent off my research assistant to collect data. We had very clear images taken from a video camera at the top, and an array of faces that might or might not include that person in an array at the bottom. People were just asked 'Is this person in this array, and if so which one is he?' Very simple task, no memory involved. We expected, on the basis of at least 20 years' research in the area, that when the viewpoints and expressions of the face at the top matched those of the face (when he appeared) in the array at the bottom, you would be 100 per cent. You would be perfect at that. And then we would look at how performance varied as you added a bit of expression change or added a bit of viewpoint change.

My research assistant came back in. She said: 'But they can't do it. They're making lots of mistakes.' 'Well, they can't possibly be making mistakes. You don't have to remember faces. You've just got to compare this face at the top with these faces at the bottom. They can't possibly be making lots of mistakes.' But they were. The face, when it appeared at the bottom, of the chap at the top, was taken on a slightly different camera. So there were some superficial image differences between the clear frame from a video at the top, and the clear picture of that person at the bottom. We discovered that the difficulties that people have in remembering faces – and the difficulties that people might have in establishing from a CCTV image 'is

[3] For a recent summary of our understanding of the field of face perception and its neurological underpinnings, see Vicki Bruce & Andy Young, *Face Perception* (2012).

[4] V. Bruce, P. Healey, A.M. Burton, T. Doyle, A. Coombes & A. Linney, 'Recognising facial surfaces', *Perception*, 20 (1991), 755-69.

[5] A.M. Burton, P. Miller, V. Bruce, P.J.B. Hancock & Z. Henderson, 'Human and automatic face recognition: a comparison across image formats', *Vision Research*, 41 (2001), 3185-95.

this the person who has been apprehended'? – isn't because the image quality is poor, and it isn't because people's memory for faces is bad (though it can be bad). It is because two different images of the same person can look very different, and two images of different people can look very similar. The best you can do, when you have got an image of one person and an image of somebody who has got a resemblance to that person, that might or might not be the same, is to say 'That person resembles that person.' That is a really important finding.[6] It has been used a great deal, in defence usually, in courtrooms, when people are trying to appeal to a resemblance between somebody apprehended and a CCTV camera image. They are trying to appeal to that resemblance and say 'That means that person was there.' No, it doesn't. It means that person *resembles* the person who was there. It gives you some information. It is useful for the investigation. But it shouldn't be used to convict.

We were doing something for theoretical reasons, which led us to a discovery that is important for completely different practical reasons. That is what science is about.

So that was an example of where we were doing something for theoretical reasons – we were trying to test our computer model of face matching – which led us to a discovery that is actually interesting theoretically but important for completely different practical reasons. And that is what science is about.

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Does that sort of research deserve public funding?

Vicki Bruce
In the particular example I was talking about, when we stumbled on this rather important observation about video image matching, that was work that was funded by one of the UK Research Councils. I think that that discovery alone vindicates that public funding.

That's not to say that all research in my area would be funded by the public sector. Some of it would be funded by private sector. So I have been involved in work on how you design remote video communication systems to capture the best things about face-to-face communication.[7] Is it the same if you talk on a video link, or talk on Skype to somebody? Is that exactly the same in terms of interpersonal impact as talking face to face? Our experiments showed it wasn't exactly the same. There are some things which are subtly different. And that's not just to do with the quality of the line. If I talk to you on Skype, I can't see what else is going on in your environment. If you suddenly look somewhere else, or make an expression or make a gesture, I don't have the context. There is an ambiguity about what is happening in your face when we are communicating remotely. Some of that sort of work might be funded by people who want to sell better video phones, for example.

But yes, I think our work justifies its public funding. Public funding usually allows us to pursue particular areas that arise during a grant, and can allow us to go on and build on those discoveries.

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Can you provide another example of where psychology research has had great public utility?

Vicki Bruce
David Clark, who is a Fellow in psychology, and Lord Layard,[8] who is an economist, were able to persuade government, on the basis of evidence, that there should be substantial investment in cognitive behavioural therapies in the NHS – rather than, or in addition to, investment in certain sorts of therapies (particularly drug therapies) – to treat people with anxiety, depression and a wider range of problems. The cognitive behavioural therapies were developed in the context of trying to help people who were struggling. They were also developed on a very strong theoretical base, about understanding the relationship between our thoughts and our feelings and our coping strategies. Many of the people who work in that area had made very distinguished, important contributions of our understanding of the cognitive and behavioural processes that lead us to construe the world in particular ways, to feel good or bad about ourselves. But those contributions have also had an enormous impact on the kinds of therapeutic treatments that are available – and importantly, given the involvement of Richard Layard in this particular case, the economic side of this. These treatments are relatively inexpensive, and therefore hugely cost-effective.[9]

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Does scholarship also have a role in promoting public understanding?

Vicki Bruce
One of the things that I think is absolutely marvellous about the recent years in this country is the way in which people's curiosity about themselves and their histories – about their personal histories through things like ancestry, about community history, about national history – has been stimulated really in the most sophisticated way. There is interest kindled by some fantastic scholars, who have been leading the way in terms of public debates, but also really high-quality television programmes and things of that sort. I think that the quality of the interface

[6] V. Bruce, Z. Henderson, K. Greenwood, P. Hancock, A.M. Burton & P. Miller, 'Verification of face identities from images captured on video', *Journal of Experimental Psychology: Applied*, 5 (1999), 339-60.

[7] G. Doherty-Sneddon, A. Anderson, C. O'Malley, S. Langton, S. Garrod & V. Bruce, 'Face-to-face and video-mediated communication: A comparison of dialogue structure and task performance', *Journal of Experimental Psychology: Applied*, 3 (1997) 105-25.

[8] Professor David Clark and Professor Lord Richard Layard were both elected Fellows of the British Academy in 2003.

[9] David Clark, 'Implementing NICE guidelines for the psychological treatment of depression and anxiety disorders: The IAPT experience', *International Review of Psychiatry*, 23 (2011), 375-84.

The quality of the interface between public life and public curiosity, and the humanities and social sciences, has never been better than it is now.

between public life and public curiosity, and the humanities and the social sciences, has never been better than it is now. I feel personally that there is more interest in matters of the mind, and society, and culture, interest in understanding ourselves, and understanding our origins and where we are going to in the future, than at any point during my own career.

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And you have contributed to that public engagement yourself.

Vicki Bruce
The piece of work that I am proudest of is one that I did with Andy Young.[10] He and I worked together to produce an exhibition at the Scottish National Portrait Gallery on 'The Science of the Face' in 1998.[11] That exhibition was a way of taking out to a wide range of the general public the things that we understood about face perception, and put that at the interface with visual art and portraiture. That was a piece of work that both Andy and I really felt very proud of – first, because the exhibition was very successful; secondly, because we learned a tiny little bit about art. But we found that that gave us a vehicle for thinking about our science which was very novel. We created a book that went with that particular exhibition, which we think was a good synthesis for a fairly introductory and general audience of our field at that time.[12]


Pictures at an exhibition

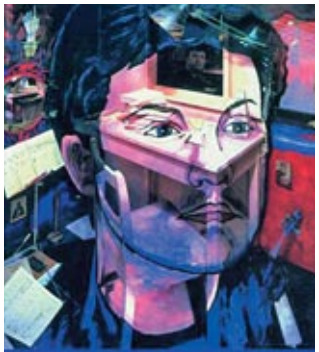
Pictures at an exhibition

The science of the face

Andy Young

Vicki Bruce

Andy Young and **Vicki Bruce** report on their exhibition at the Scottish National Portrait Gallery.



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Were the exhibition and book well received?

Vicki Bruce
We got extremely good feedback from that exhibition. The National Portrait Gallery in Scotland was very pleased with their visitor numbers. We got, with one exception, very good reviews of that exhibition, and very good reviews for the book, which also won a prize.

But we were thinking it was the best thing we did before we got the feedback, because you sort of know when you are engaged in something that you think is really working. It was both a synthesis across a wide range of face perception issues, and it was working at an interface with an unfamiliar discipline for us at that time. It was extremely challenging, and an enormous amount of fun. And I think that such a broad-based communication challenge, while also really enjoying it, is the hallmark of intellectual life for me.

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What did election to the Fellowship of the British Academy mean to you?

Vicki Bruce
I was elected to the British Academy at a particularly productive phase in my career, so it felt like a good endorsement of the quality of my own work. But also it was a time at which the numbers of psychologists in the British Academy were beginning to grow – which begins to reflect the size or scale of the discipline outside the Academy. According to the last numbers I saw, psychology is the fourth most popular undergraduate subject now. If it is the fourth most popular undergraduate subject, you can imagine how many academic psychologists there are in universities delivering this. So I was pleased to be part of this growing recognition within the humanities and social sciences of psychology as an important discipline.

Psychology is also one of the disciplines in the social sciences that has a particularly strong interface with the Royal Society. So some Fellows of the British Academy are also Fellows of the Royal Society. We are one of the disciplines that helps build these bridges with the Royal Society.

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As its Vice-President for Communications and External Relations, what are your ambitions for the British Academy?

Vicki Bruce
One of the things that the British Academy has in recent years begun to do really well is to have intellectually rigorous, exciting public events and debates – and not just in London. The other thing that some of us are very excited about in the Academy is that we realise that we have got not just an opportunity but an obligation to do more things directly aimed at younger audiences. So, getting out more and reaching out to a wider range, particularly in terms of the future generations of humanities and social scientists: that is what I want us to be doing.

[10] Professor Andrew Young was elected a Fellow of the British Academy in 2001.
[11] See Andy Young & Vicki Bruce, 'Pictures at an exhibition: The science of the face', *The Psychologist*, 11:3 (March 1998), 120-5.
[12] Vicki Bruce & Andy Young, *In the Eye of the Beholder: The Science of Face Perception* (1998).